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T, U. Dry seed capsules showing exit holes of *Mompha circumscriptella* and *Mompha brevivittella.*

V. Primrose stem during the winter showing the dry, open seed capsules.

STUDIES IN RHYNCHOPHORA. IX. THE SEXES OF CONOTRACHELUS BREVISETIS CHAMP.

BY D. SHARP,

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The species was described by Champion (Biol. Centr. Amer., 4, pt. IV, p. 402, pl. 20, figs. 14, 14*a, b,* and *c*), who recognized it as occurring in Guatemala, Panama and Venezuela. I have recently received a series from French Guiana which are apparently this species; Mr. Champion after comparison of a pair of the Guiana examples has decided that they are the same as the Central American form. The species is remarkable externally on account of the last dorsal being unusually extended forwards on the venter, as described by Champion, "in the male the pygidium exposed and becoming ventral." This character induced me to dissect some of my specimens, as I have found that unusual shape of the last body-segment in the male is usually accompanied by peculiar conformation of the internal sexual apparatus. And on making dissection I found so strange a structure that I forwarded specimens to Mr. F. Muir in Honolulu. He and Mrs. Muir examined them carefully, and were so good as to make drawings, which are reproduced on the plate accompanying this paper.

The male, figures 2 to 6, has the apex of the median lobe deflexed so that it is at right angles with the body of the lobe, the struts *ms.* are very short. The tegmen, *tg.,* is a ring, without strut, but the sides of the ring are prolonged as two delicate superior appendages, *tgt.,* the dorsum of the ring has only a very slender connection with the side (fig. 3 shows this angle rather too robust). The body, *ml.,* of the median lobe shows a depression, *mo.,* commencing before the deflexed apex and continued for some distance on the deflexed process; ventrally opposite to the median orifice is a membranous bulge, *d*. If the median orifice be looked at as perpendicularly as possible, it presents somewhat the appearance shown in fig. 4, which shows a central chitin sclerite, *c.*, and a median one, *ta.*; the latter varies in appearance according to whether the sac is greatly retracted. When the sac is extended it is found to be a bladder-like structure with a lobe at its base; this lobe consists of very complex hard pieces partially shown in fig. 6, and through it runs the ejaculatory duct, *ej.*, opening on a spot *fo.*, in the middle of this transfer apparatus; this spot is the functional orifice where the sperm leaves the male structure for transference to the female. The extreme hardness and the very complex shape of this transfer apparatus is unusual in the Curculionidæ; but in the Tomicidæ division of the Scolytidæ there exist very remarkable analogous formations, the "Aufsatz" of Lindeman, which I anticipate, when carefully examined to find the ejaculatory duct, will also be found to bear the functional orifice.

The position of this transfer apparatus at the base of the main division, *is.*, of the sac is also remarkable, as it is usually closely connected with the wall of the main sac, and placed more or less at its apex.

The shape and nature of the transfer apparatus differs greatly in the various forms of Rhyncophora, so that it will be difficult to generalize it for the purpose of definition of the great groups, but it will be found very important in the case of definition of genera and tribes.

Much mystery at present surrounds the male genitalia, which is a sign of our ignorance. We say that as regards the great modifications of the outer skeleton of an insect that they are "adaptations." But no one so far as I am aware has endeavored to account for the great diversities we find in the male organs. If they are the results of "adaptations," what is the nature of these?

The first idea that suggests itself is that there will be found to be a correlation between male and female peculiarities, and I believe that this will prove to be the case to a considerable extent. Unfortunately we know but little of the female structures in Coleoptera. In 1847 Stein published a very valuable work on the subject, "Die weibliche Geschlectsorgane der Käfer," Berlin, and this remains the only general work on the subject, but deals with only 3 or 4 Rhyncophora; Nüsslin has since given up particulars of the structure of 15 or 16 forms, but they all belong to the Scolytidæ, which is a very exceptional and limited division of the Rhyncophora (Zeitschr. wiss. Ins. biol., 7, 1911, p. 306, etc.).

Our means of forming a conclusion on the point I am alluding to are therefore very limited, and the question will have to be answered by concomitant considerations of the males and females of particular species. The female structures are more difficult of investigation than the male, and I have paid comparatively little attention to them, still I have formed the opinion that there exists a correlation of the kind I have suggested and that *Conotrachelus* offers an exemplification of it.

Figure 1 gives a representation of the female structure of the species, where *ut.* is the bursa, *spt.* the spermatheca and *ovd.* the common oviduct; as regards the parts near the anal aperture the figure is diagrammatic, but the other parts are fairly exact.

The sperm has to be lodged in the spermatheca, which is connected with a long, slender duct to the bursa at the spot where it joins the oviduct. The sac in the male, fig. 5, *is.*, enters the bursa, and brings the functional orifice of the transfer apparatus to the mouth of the duct of the spermatheca; there is thus formed a continuous canal extending from the testes of the male to the spermatheca of the female.

Of course, one swallow does not make a summer, and one case in which we can imagine a correlation does not show that such a correlation is general, but I may mention that in the Celenthetides, where the male sac is extraordinarily long and slender (see Trans. Ent. Soc. London, 1918, pl. IX, f. 7), there is a corresponding elongation of the female passages. It must not be forgotten that these membranous parts are extremely elastic in both the female and the male and that it is very difficult to restore them to their natural functional shapes.

But if it be granted that there is a correlation between male and female structures this only increases our difficulty in understanding their variety and complication.

In the primitive condition, exemplified in *Archotermopsis* of the Termitidæ the female possesses a short oviduct, with a spermatheca having a very short duct, and colleterial glands having a separate orifice on the ninth sternite, while the male has no copulatory apparatus, except the short muscular ductus ejaculatorius. (Imms., Trans. R. Soc. London, B, No. 361, 1919.) It is a long step from this simple condition to the state we find in the Rhyncophora, and yet during the evolution of this complex condition a successful correlation is maintained between the male and female structures, and this in spite of their ever-increasing divergence. It would appear at first sight that it would have been better to retain the original simplicity of the sexual structures.

At present I can see no way to comprehending the great complication of the copulatory structures that prevails in the higher insects, and that perhaps reaches its greatest extent in the Lamellicornia and Rhyncophora in Coleoptera.

One slight suggestion may be made as to the complexity of function of the female portion of the genital conduit, for its most important function is the transmission of the egg to a suitable position for its successful development; and it has also to receive the sperm from the male, to preserve it in a special receptacle, and also to fertilize each egg before its extrusion.

For each of these purposes special structures exist; but at present we know very little about the functions. Especially obscure is the process of fertilizing the egg. The spermatozoön has to pass along the duct from the spermatheca which is sometimes of extraordinary length, much longer than in *Conotrachelus brevisetis,* while in other cases it is quite short. The function of the bursa is also obscure.

We now know that in some species of Rhyncophora males are not known to exist though females are abundant; hence parthenogenesis undoubtedly occurs, and it is clear that in the history of the species the female is more important than the males, and it seems probable that in the evolution of the structures under consideration the female has led the way, and the male structures have developed in correlation with the changes in the female. But as to how this necessary correlation has been brought about I am unable to offer any suggestion of real importance.

If this paper has any value it is chiefly due to Mr. and Mrs. F. Muir of Honolulu, who made the drawings and took considerable pains to ascertain difficult points of the anatomy.

EXPLANATION OF PLATE IV.

GENITALIA OF CONOTRACHELUS BREVISETIS CHAMPION.

Fig. 1. The female parts: *a,* space where the area is somewhat contracted, corresponding with the space *b* in fig. 5; *an,* anal orifice; *ovd,* the common oviduct; *spt,* spermatheca with its gland; *ut,* bursa.

Figs. 2, 3, 4, 5 and 6. The male parts.

Fig. 2. Profile of the ædægus with the sac indrawn, but with tegmen extended.

Fig. 3. Tegmen dissected off the median lobe.

Fig. 4. Apical portion of the median lobe, showing median orifice for the protrusion of the sac and transfer apparatus.

Fig. 5. Apical portion of median lobe, profile with sac extended.

Fig. 6. Face of transfer apparatus.

In figures 2 to 6 the lettering is uniform, as follows: *b,* contracted part of the sac; *c,* hinge or volet; *cm,* connecting membrane; *d,* membranous bulge accommodating the transfer apparatus when the sac is retracted; *e,* outer shield of transfer apparatus; *ej,* ejaculatory duct; *fo,* functional orifice; *is,* the sac; *ml,* median lobe; *mo,* median orifice; *ms,* strut of median lobe; *ta,* transfer apparatus; *tg,* tegmen; *tgl,* tegminal lobe.

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THE TRUE KATYDID NEARLY EXTINCT IN NEW YORK CITY.

By WM. T. DAVIS,

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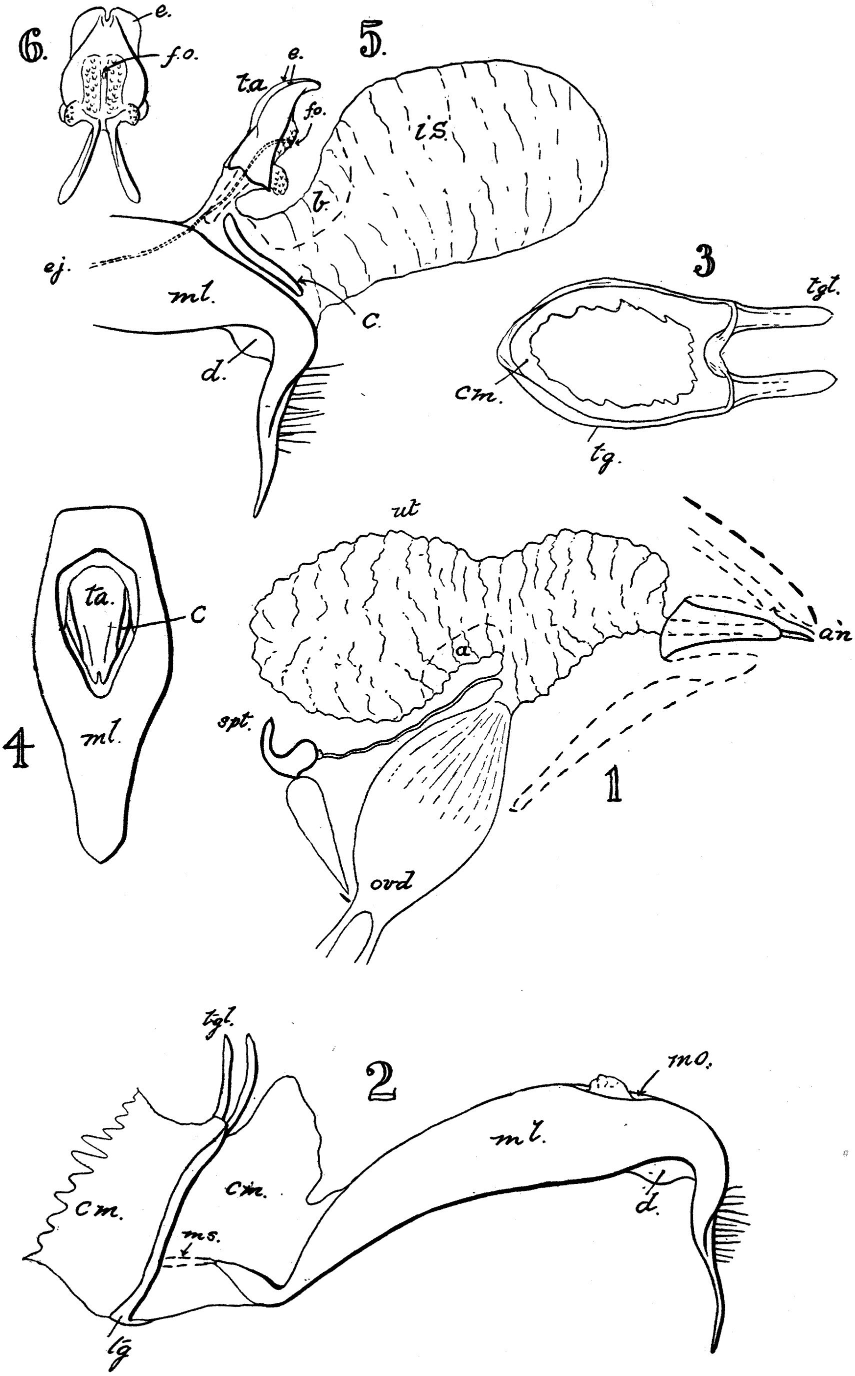
The true katydid, *Pterophylla camellifolia* Fabr., is either extinct or nearly so on Staten Island, a borough of New York City. It used to be very common there, and as late as August 14, 1908, the writer noted it "quite numerous and very noisy in the tall trees in the Egbertville ravine" near the central part of the Island. There are still considerable forested areas on Staten Island that would seem to be as suitable for the insect as similar places on Long Island and in New Jersey, and indeed it used to frequent these very same trees. Why it has died out is not known, except possibly the air is no longer as pure as formerly, for there are now numerous factories along Arthur Kill, the smoke from which may have affected the foliage on which it feeds. However, it is no longer present even on the ocean side of the Island. In our investigation that carried us



CONOTRACHELUS BREVISETIS CHAMP.